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IMPORTANCE OF EXERCISE NEEDS IN DIABETIC PATIENTS FOR ORAL IMMUNITY

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ABSTRACT

The lacuna in realising the importance of exercise needs in diabetic patients for oral immunity is noted. This aticle reviews and emphasises the above statement. Considering the branching complications of Diabetes mellitus, and the various beneficial effects of exercise in to account, an idea is proposed, that exercise might be a remedy for few of the complication of diabetes mellitus with evidences.

KEYWORDS: Oral immunity, Diabetes mellitus, Exercise.

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INTRODUCTION

Diabetes Mellitus is the most common metabolic disorder now a days leading to many severe complications. The more common and attention seeking complication is oral infection. Some of the oral infections due to diabetes mellitus are dry mouth, oral mucosal lesions, periodontitis, gingivitis[1, 2, 3].The levels of salivary IgA, which serves as a first line of defence against oral pathogen is found to be lower in diabetic patients [4]. This low level of sIgA is the reason for the frequent oral infections in diabetic patients[4]. There are evidences showing moderate exercise improving the sIgA level and thereby improving oral immunity in elderly people[5] and also exercise has immune modulatory function [6, 7]. The purpose of the study is to motivate research on the effect of exercise in oral immunity in diabetic patients.

DIABETES MELLITUS: Diabetes mellitus is disturbed syndrome of carbohydrate, protein and fat metabolism[8]. This diabetic syndrome is due to insulin deficiency along with the positive effects of hormones that are antagonist to insulin [9, 10]. The characteristics of diabetes mellitus includes hyperglycemia and glycosuria, polyurea, polydypsia, Dehydration (intra and extra cellular), hypotension, loss of weight, hypertriglyceridemia, metabolic acidosis etc[1, 11].Some of the major complication includes artherosclerosis, retinopathy, nephropathy, peripheral neuropathy.

The incidence of diabetes mellitus is rising at a rapid rate. It is estimated to be 180 million in the year 2000, 221 million in the year 2010 and by 2025 it is expected to be 320 million [12, 13]. Diabetes mellitus apart from its usual complications has gained its attention on oral complication among the physicians. Some of the oral complications are xerostomia, periodontitis, gingivitis, oral mucosal lesion, dental abscess [1,2,3].

ORAL MUCOSAL IMMUNITY: Like any other immunity in our body, oral mucosal immunity is very essential to protect the teeth, gums, oral mucosa. Decrease in oral immunity lead to serious complications like tooth caries, plaque, gingivitis, periodontitis etc., [1,2,3]. The main element in offering oral mucosal immunity is saliva and its components.

SALIVA AND ITS COMPONENTS: Saliva is a bodily secretions secreted from three pairs of salivary glands (parotid, submandibular and sublingual) [14, 16]. Saliva plays an important role in protecting the oral mucosal surface as it contains many proteins aiding the immunity like lysozyme,sIgA, and many other defence proteins (defensins, Histatins, Lactoferrin) [15].

However the whole saliva is necessary for the protection of tooth surface. Acquired pellicle (a calcium hydroxide binding salivary protein) is necessary for exclusion of oral pathogen from surface.[14,16]. Also the mechanical flow of saliva plays important role in flushing the microorganism.

SALIVARY ANTIBODIES: Salivary antibodies are the first line of defence protecting the oral mucosal surface which mainly includes sIgA and IgG[14, 16, 17]. sIgA accounting for 90-98%. IgG for 1-10% and also IgM, IgD and IgE in less proportions.[16, 17]

Two molecules of IgA are linked by J chain to form dimericsIgA. The J chain has affinity to the secretory component of polymeric immunoglobulin receptor (pIgR) present in the basolateral membrane of the salivary epithelium [17]. The secretory component is cleaved from the pIgR along with sIgA and released via the apical surface by exocytosis into the salivary duct.

The secretory immunoglobulin is resistant against any other protein degradation aiding efficient oral immunity [17].

FUNCTIONS OF SIgA:

- Binding and agglutination of pathogens leading to entry of the complex into stomach where it is digested [20].
- The oral pathogens are immobilized by the secretory Ig to the mucosal surface and removed by means of surface exclusion [18, 19].
- Oral mucosal surface is rich in antigen presenting cells and also there is invasion of neutrophils and granulocytes which altogether responsible for phagocytosis [17, 20].
- It is now very clear that the sIgA is very essential for oral mucosal immunity and the diabetic patients are more prone for oral infections (periodontitis).

CAUSES FOR ORAL INFECTIONS IN DIABETES MELLITUS:

- The diabetic patients had more often oral infections (periodontitis) than non diabetic patients because of lower sIgA levels in their unstimulated whole salivary samples [4].
- Although there are evidences showing high sIgA levels in the unstimulated whole salivary samples of diabetic patients which could be a compensatory immune response to the presence of Candida species [21, 22].
- As it is already mentioned that the mechanical flow itself is necessary for the flushing of microorganism there are evidences that the salivary flow rate is reduced in diabetes mellitus especially in insulin dependent diabetes mellitus. But in contrary to above

evidences, the decreased salivary flow rate in insulin dependent diabetes mellitus is associated with increased sIgA[23].

But in either case whether the salivaryIgA is reduced or the salivary flow rate is decreased (with increased sIgA) the oral infection is not compromised in diabetes mellitus.

ROLE OF EXERCISE IN IMMUNITY**:** Exercise has created an awareness among people because of the fact that it has a variety of beneficial effect on almost all the systems in human body. The main aim of motivating exercise is to achieve the following,

- maintaining physical fitness
- slow down ageing process
- Reduce or to post pond the risk of various disease.
- To create a state of mental fitness

Exercise increases heart rate, cardiac output, stroke volume, blood pressure (SBP), and Blood flow.

Increases pulmonary ventilation, perfusion, and diffusion.

Increases ADH & Aldosterone for fluid and salt retention during exercise.

ACTH and cortisol provides energy by mobilising fat and proteins.

Decreases insulin secretion, because exercise increases the glucose uptake by muscle fibres without actual use of insulin.

Recent studies have shown that exercise has even the power of modulating immunity. Various mechanisms have been put forth in regarding to this statement [25].

- Exercise increases the flushing out of wastes from body including the disease causing pathogens.
- Exercise increases the circulation of antibodies and WBC's improving the immune functions.
- Reduces certain stress hormone which is anti immunity in its function.
- Rise in body temperature during exercise which acts as bacteriostatic.

Too much of anything is good for nothing. Although exercise has various beneficial effects its intensity and duration is highly accountable. Recent studies has proved,

- Moderate exercise boosts the immune system by increase in production of macrophages [26, 27].
- Severe exercise increases the secretion of certain stress hormone like cortisol which depresses the immune function [24, 25].

- Several studies have also proved that there is increased risk of Upper Respiratory Tract Infection (URTI) in athletes [28, 29].

EXERCISE AND SALIVARY IMMUNITY:

Generally exercise is classified as mild, moderate and severe exercises depending upon the duration and intensity of training. This article reviews that the moderate exercise increases the oral immunity , the moderate exercise like the 30 minutes of walking in tread mill or cycling in bicycle ergometer. The oral immunity reduces during severe exercises like elite atheletes[5].

- As stated earlier exercise has ability to modulate salivary immunity. Evidences for the occurrence of URTI in young athletes are abundant due to the fact that the sIgA levels are decreased in severe exercise[30, 31 ,32, 33].
- Decreased sIgA is associated with URTI [33].
- But the evidences regarding increased sIgA level during regular moderate exercise even in elderly subjects are also available [5].

The possible mechanism behind increased sIgA secretion during moderate exercise and decreased sIgA secretion during severe exercise is explained below [34].

- The secretory IgA are produced by the plasma cells and are mobilised into the duct by pIgR. The concentration of IgA in saliva is therefore dependent on IgA production and rate of secretion. The autonomic nervous system modulates the rate of IgA production and mobilisation.
- During moderate exercise the sympathetic stimulation of salivary glands increases the production and mobilisation of IgA thus increasing in concentration of IgA in saliva.
- During severe exercise the concentration of IgA is reduced and the availability of pIgR is reduced and so IgA in saliva is reduced.

CONCLUSION:

This article summarises that,

- The salivary IgA is reduced in Diabetes mellitus and there is frequent oral infection.
- Exercise has capability to modulate immune functions.
- Moderate exercise increases sIgA even in elderly patients.
- Severe exercise decreases sIgA levels.

  The evidences for the betterment of oral immunity by moderate exercises even in elderly subjects have thrown light on the fact that moderate exercises could be a remedy for the oral complications in diabetic patients. Accordingly one can clearly

understand the lacuna in the research field that further studies are required to prove betterment of salivary immunity by moderate exercise in diabetic patients in whom sIgA levels are depressed.

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